CORPORATE FORECASTING

LABOUR FORCE PARTICIPATION IN THE LOCAL LABOUR MARKET: AN ECONOMETRIC ANALYSIS

Patrick Walters

Research Paper No. 18

THE CITY OF Edmonton PLANNING AND BUILDING

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BY

PATRICK WALTERS

Important Note

This Research Paper has been prepared by the Corporate Forecasting Group, Long Range Planning Branch, Planning and Building Department. The Paper documents research results as part of an ongoing forecasting activity. Neither the methods nor the results have been endorsed by the City of Edmonton.

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EXECUTIVE SUMMARY

Topic	Comment
Purpose of Report	The report examines labour force participation in Alberta and Edmonton and attempts to answer: (a) whether or not labour market developments in the City and Province are isolated events? (b) whether or not labour force participation will continue to increase in the short run? and (c) what are appropriate empirical equations to forecast labour force participation.
Theory	Labour force participation is treated by economists as a problem of resource allocation, whereby the individual allocates his or her time among competitive alternatives such as market and non-market time. The trade-off between market work and non-market time is the wage rate. As a result anything that increases the opportunity cost of non-market time will improve the individuals chances of labour force participation.
Empirical Analysis:	
Men	The labour force participation has declined in Alberta and Canada as well as in most industrialized countries. The main factors influencing labour force participation are urbanization, education, family income and age.
Women	The labour force behaviour of Canadian women is in keeping with changes in other industrialized countries, where the participation rate has increased over time. The labour force participation of women is influenced by the following factors: education, urbanization, fertility, family income, social factors and age.
Empirical Equations:	Equations were specified for Alberta and Edmonton. The Alberta equations were classified by sex.
Alberta - Men	The male labour force participation rate (LFPR) was explained by growth in employment, the fraction of the provincial population that resides

in Edmonton and Calgary and the lagged labour force participation.

Alberta - Women

The female labour force participation was explained by the growth in employment, the average provincial wage rate and the lagged labour force participation rate.

Edmonton

The Edmonton labour force participation rate was determined by the change in provincial employment, the provincial wage rate and a dummy variable to indicate a break in the data series between 1974 and 1975.

Simulation Results:

The LFPRs in Alberta and Edmonton are forecasted to increase in each year of the 1986-1992 period. In Alberta the LFPR is expected to increase from between 72.09 and 72.07 percent in 1986 to 74.45 and 73.94 percent in 1992. The Edmonton LFPR is forecasted to increase from 71.58 percent in 1986 to 74.05 percent in 1992.

Alberta and Edmonton

The male labour force participation rate is explained by growth in employment, the fraction of the provincial population that resides in Edmonton and Calgary, and the male lagged labor force participation rate.

The female labour force participation rate is affected by the growth in employment, the average provincial wage rate and the female lagged labour force participation rate.

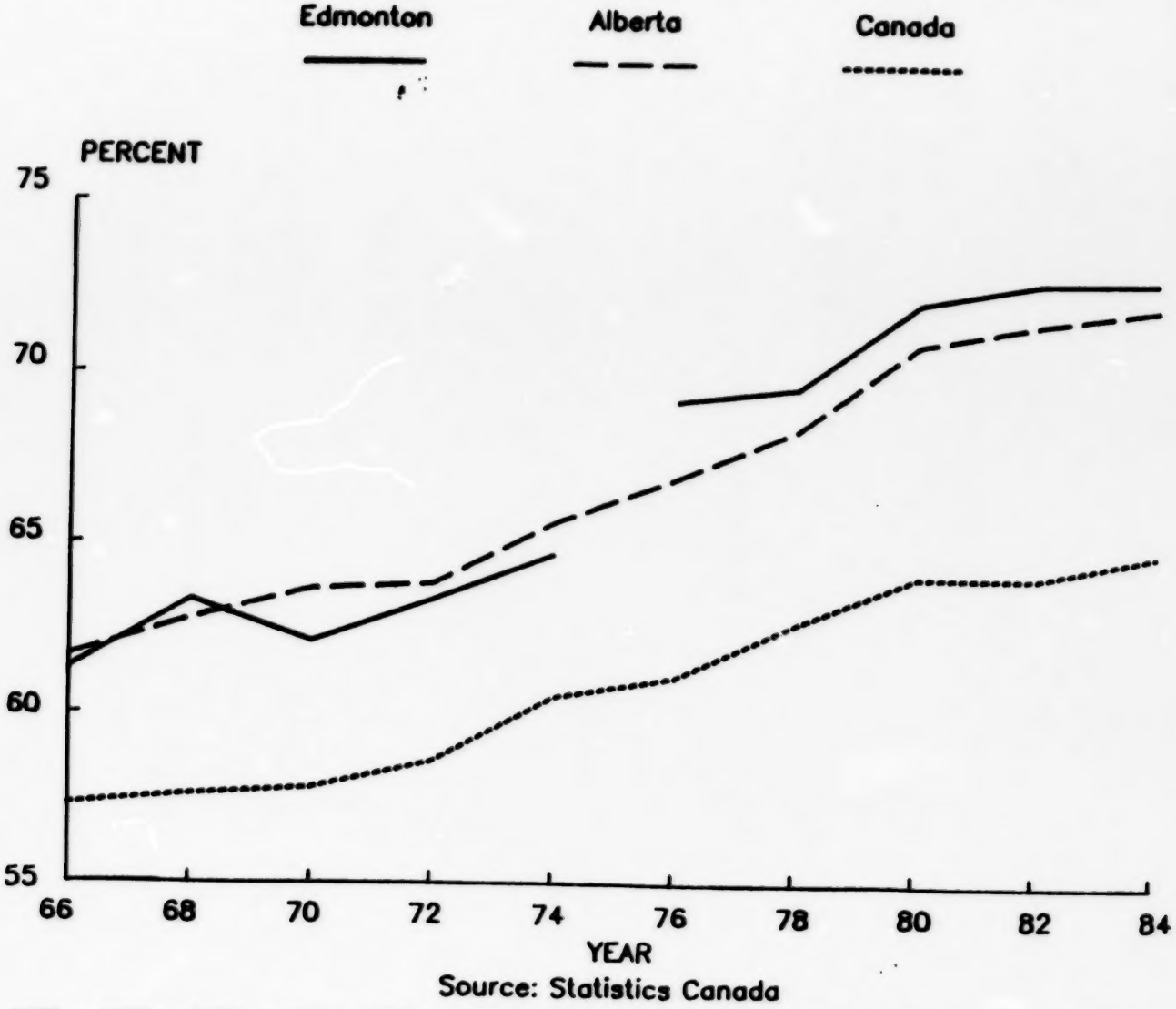
The labour force participation rate is expected to increase in each year of the forecast period (1986-1992) for the Alberta and Edmonton Economies.

Job creation is projected to fall short of the growth in the labour force and as a result, the unemployment rate is forecasted to increase in Alberta and Edmonton over the forecast period.

Recommendation:

The City of Edmonton and other Stakeholders should therefore pay greater attention towards maintaining and/or improving the regional employment base.

Figure 1 – Labour Force Participation: Canada, Alberta & Edmonton 1966–1984



Source: Statistics Canada

1. INTRODUCTION

The report examines labour force participation in Canada, Alberta and Edmonton[1] and attempts to answer: a) whether or not labour market developments in the City and Province are isolated events? b) whether or not the labour force participation rate will continue to increase in the short run? and c) what are appropriate empirical equations to explain and forecast labour force participation?

The Canadian labour force participation rate (LFPR) increased from 57.3 percent in 1966 to 64.8 percent in 1984 with some minor fluctuations. Over the same period, the working age population climbed from 13,083,000 persons to 19,148,000 persons or by 46.4 percent. In addition, the total labour force grew from 7,493,000 persons to 12,399,000 persons or by 60.1 percent, and as a result, a significant portion of the increase in the labour force size is due to growth in the LFPR. For example, if the LFPR was held constant at the 1966 level of 57.3 percent and was applied to the 1984 working age population of 19,148,000, an estimated labour force of only 10,971,804 persons would be obtained compared to the observed 12,399,000 persons.

The increase in the labour force participation has also occurred in Alberta and in Edmonton. The provincial LFPR grew from 61.7 percent in 1966 to 72.13 percent in 1984 (see figure 1). Similarly, the LFPR for the Edmonton C.M.A. has increased from 61.3 to 71.6 percent over the same period. The Edmonton working age population in 1966 was 266,000 persons and by 1984 this figure grew to 523,000 persons or by 97 percent. Over the same period the labour force increased by 134 percent. If the LFPR was held at the 1966 level of 61.3 percent, then the labour force would have grown to only 320,000 persons instead of the current 381,000 persons. At the same time, employment grew by 106 percent, which is in sharp contrast with the 134 percent growth experienced by the labour force. Because of the local economy's inability to create jobs at the same (or faster) rate as the labour force growth, the unemployment rate increased in the local economy.

The report is broken down into the following areas:

1. Theory (Section 2)

   The aim of this section is to develop a framework for analysis by outlining those factors that are expected to influence an individual's decision to participate in the labour market.

2. Empirical Analysis (Section 3)

   The empirical literature will be reviewed in order to determine whether or not there is statistical support for the variables identified in the theory.

3. Specification of Empirical Equations (Section 4)

In this section of the report, regression equations will be developed to explain and forecast labour force activity in Alberta and Edmonton. The selection of variables for inclusion in the equations will be influenced by the empirical and theoretical reviews in parts 1 and 2 of the paper.

4. Simulation Results (Section 5)

The empirical equations that were specified in part 4 will be incorporated into the Edmonton Econometric Model. The forecasts that are obtained from these equations will be compared with forecasts from other individuals and agencies.

5. Conclusions

Conclusions will be provided on the following topics:

- Labour Market Developments
- Forecasted Participation Rate
- Empirical Equations
- Simulation Results
- Recommendations

2. THEORY

A popular tool for explaining an individual's decision to participate in the labour market[2] is the model of leisure-income (Cain 1973). This question is treated by economists as a problem of resource allocation, since the individual is seen to allocate time among competing activities, given a budget constraint[3]. The simplest set of such alternatives is the dichotomy: work and leisure, where the individual is assumed to use income to purchase goods.

Consumer theory predicts the effects of changes in relative prices and income on consumption (Henderson and Quandt 1971). Since the price of leisure is foregone wages, a rise in the wage rate makes the consumption of leisure more expensive and thus increases the worker's chances of participating in the labour market. Therefore, any factor which increases the opportunity cost of leisure (non-market time) serves to improve the individual's chances for labour force participation[4].

The presence of young children in the home enhances the value of non-market time for some members of the household and thus reduces their probability of partaking in the labour force because the individual now regards the time spent on home based activities as being more valuable than the market wage. As children advance in age, they require fewer hours of direct supervision, and as a consequence, the opportunity cost for market work increases. On the other hand, the availability of home making substitutes reduces the value of non-market time. These substitutes include the presence of grandparents in the home, affordable day care facilities and fast food restaurants.

An increase in a household's non-wage income (unaccompanied by any other change) has a negative impact on their labour force participation, as non wage income increases the value of non-market time. This assumes that leisure is a normal good and that its consumption grows with increased income. A student who works part-time may be persuaded to devote his or her attention to full-time study by withdrawing from the labour force. The same argument can be made for the individual who is close to retirement.

Education is another factor likely to improve an individual's chances of participating in the labour market. The more educated an individual the greater would be his or her market wage and as a consequence the greater the opportunity cost of leisure. In addition, the educated individual is able to obtain satisfactory and rewarding employment.

2.1 Summary

The price of leisure is foregone wages and, as a consequence, a rise in the wage rate makes the consumption of leisure more expensive and thus improves the worker's chances for participating in the labour market. Therefore, any factor that increases the opportunity cost of non-market time serves to enhance the individual's changes for labour force participation.

Figure 2
Labour Force Participation: Alberta 1966–1986

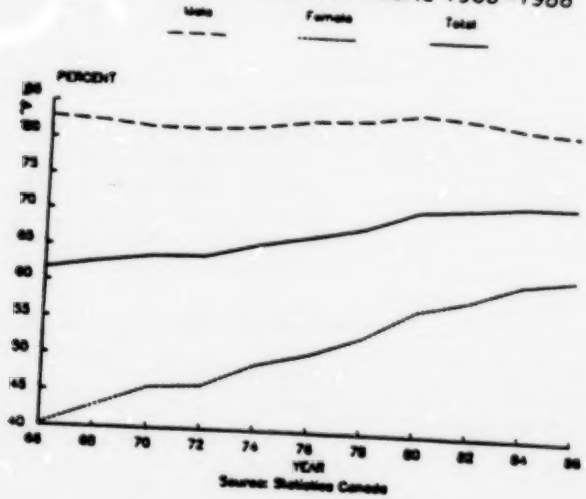


Figure 3 – Participation Rate by Years of Schooling, Both Sexes: Alberta 1975–1983

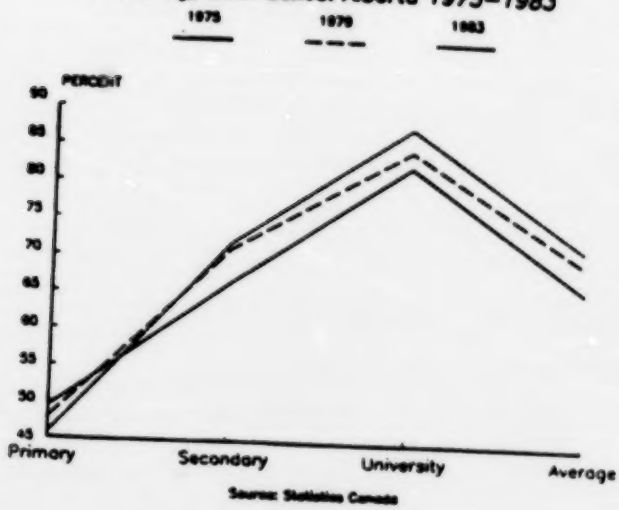
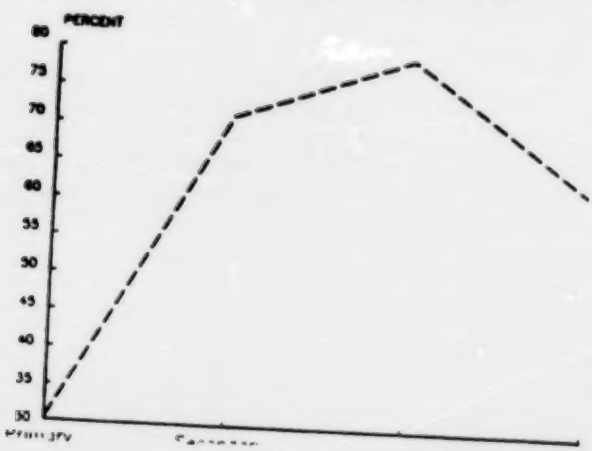


Figure 4 – Participation Rate by Years of Schooling, Females: Edmonton 1981



3. EMPIRICAL ANALYSIS

The empirical literature is reviewed in this section to determine if there is statistical support for the theory that was outlined in Section 2. The review examines several cross section and time series studies.

3.1 Cross Section Studies

These studies are based on individual data at a given point in time. This approach allows the researcher to control for the influence of time on labour force behaviour and to relate characteristics of each individual in the data base to differences in their labour force participation.

3.1.1 Women

The LFPR for women has increased continuously over the last sixty years in all geographic areas[5]. For example, the participation rate for Canadian women in 1921 was 19.9 percent (Ostry and Zaidi 1972) and by 1984 this climbed to 64.8 percent, while in Alberta the female LFPR increased from 13.2 percent in 1921 to 61.7 percent in 1984 (Figure 2). At the municipal level the labour force participation rate grew from 61.3 percent in 1966 to 72.9 percent in 1984. The labour force behaviour for Canadian women is in keeping with changes in other industrial countries[6]. In Sweden and the United States the labour force participation rate was 55.2 and 46.3 percent in 1975 and they increased to 61.5 and 53.6 percent in 1984 respectively (see appendix B).

Several explanations have been advanced both in the U.S. (Mincer 1962) and Canada (Nakamura and Nakamura 1985) for women's increased participation in the labour force. The following are the factors that have been identified as having an influence on women's labour force participation: education, urbanization, fertility, income, social factors and age.

3.1.1.1 Education

The data show that there is a strong correlation between years of schooling and labour force participation (see Figure 3). In 1975 and 1983, the LFPR in Alberta was 45.8 percent for individuals with 0-8 years of schooling and 87.7 percent for those with a university degree. In Edmonton, the 1981 Census confirms the link between education and labour force participation (Figure 4). The above results are expected. Economic theory suggests that the educated are able to command a higher wage rate, because of the investment in training (Becker 1964)[7]. As a result, the opportunity cost of non-market activities is much more costlier.

The strong secular increase in the labour force participation of women is not explained solely by improvements in the education levels of the female work force since the data demonstrate that there is a significant difference in the labour force participation rates of men and women even though they enjoy the same level of education (Table 1). In addition, the LFPR for men has been

TABLE 1

Median Years of Schooling for Population Aged 15+ 1971 and 1981

Area		Male	Female
Quebec	1971	9.8	9.7
	1981	11.5	11.3
Ontario	1971	10.9	10.9
	1981	12.2	12.1
Alberta	1971	11.1	11.4
	1981	12.3	12.2
B.C.	1971	11.3	11.5
	1981	12.3	12.2
Canada	1971	10.5	10.6
	1981	11.9	11.8

Source: Statistics Canada, Education in Canada, Cat 81 - 229 Annual

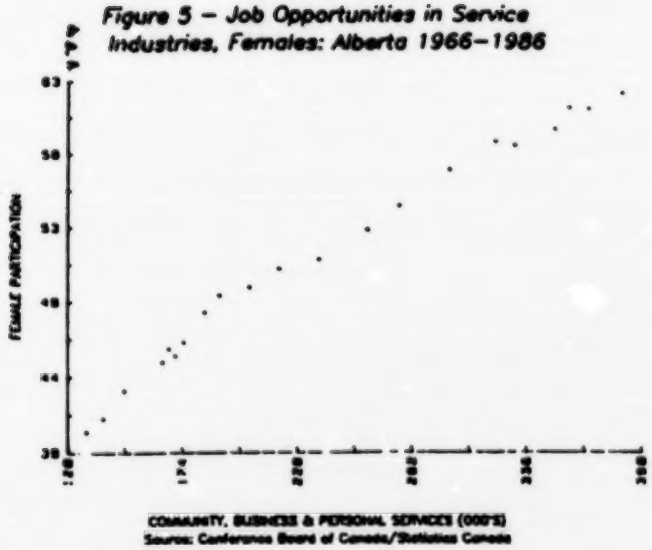
TABLE 2

Participation Rates of Married Women, Husbands Present, by Age Group and the Presence of Children in the Home, Canada, May 1971 and May 1976.

	Aged 15-34	Aged 35-44
With children under six		
1971	28.0	25.4
1976	36.9	35.8
Absolute increase	8.9	10.4
Relative increase (percent)	31.8	40.9
With children, all over six		
1971	46.0	44.2
1976	54.9	536
Absolute increase	8.9	9.4
Relative increase (percent)	19.3	21.3
With no children present		
1971	73.9	59.4
1976	77.5	65.5
Absolute increase	3.6	6.1
Relative increase (percent)	4.9	10.3

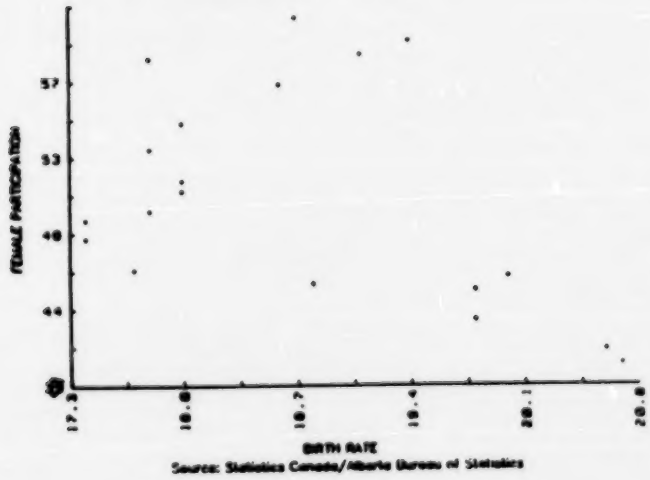
Source: Ciuriak, D and H. Sims, Participation Rate and Labour Force Growth in Canada, Department of Finance Canada. 1980.

Figure 5 – Job Opportunities in Service Industries, Females: Alberta 1966–1986



Source: Conference Board of Canada/Statistics Canada

Figure 6 – Participation and Birth Rates, Females: Alberta 1966–1984



Source: Statistics Canada/Alberta Bureau of Statistics

declining over time. The growth in the female LFPR is therefore due to other factors.

3.1.1.2 Urbanization

As Alberta changed from an agricultural economy (of the 1900s, that relied on male labour) to a modern economy of the 1960's and 1970's (that used both male and female labour) employment opportunities for female workers were created in the non-goods producing sectors such as finance and public administration (Alberta Bureau of Statistics 1980) (figure 5). The movement of women into the labour force was facilitated by improvements in household appliances and the development of effective substitutes for home produced goods and services (Schweitzer 1982).

3.1.1.3 Fertility

Economists (Long 1958) have argued that the decline in fertility rates in North America has contributed to the secular increase in the labour force participation rate of women. The data for Alberta shows that the birth rate was 20.9 births per 1,000 population in 1966 and this declined to 17.4 per 1,000 population in 1974. This development was also paralleled in Edmonton where the birth rate fell steadily from 22.0 births per 1,000 population to 16.6 births per 1,000 population in 1974. After the fertility rate bottomed in 1974, it rose with some fluctuations, to reach 18.7 births per 1,000 population in 1984. The decline in fertility therefore does not explain the increase in labour force participation between 1975 and 1984 in Edmonton and Alberta[7] (see Figure 6). On the other hand, the data from the 1971 and 1976 censuses shows that there is a strong inverse correlation between the labour force participation rate for women and the presence of pre-school children in the home. This relationship is also supported by data from the U.S. (U.S. Bureau of Labour Statistics 1985). Some analysts (Cuiriak and Sims 1980) have responded to this paradox by arguing that the causation between fertility and labour force participation is not clear, as it is difficult to untangle cause and effect[9].

3.1.1.4 Income

Married women have been observed to have a lower labour force participation rate than single women. The general explanation that is advanced by economists (Mincer 1962) is that the decision to participate in the labour market must be treated in the context of the family and household, where the individual has two sources of income: a) labour income and b) non-labour income[10]. Labour income is defined as the income that is derived from the individual's own labour market activities. In the case of labour income, economic theory predicts that the individual will respond to a higher wage offer by substituting market work for non-market tasks. Non-labour income is regarded as income from sources other than the individual's own labour income and, as a consequence, for the married woman, it includes the income of the husband. The theory suggests that an increase in non-labour income will increase the preference for leisure (Cain 1973). In a Canadian study on cross section data, Gunderson (1977) found that there is a negative relationship between the labour force participation rate of married women

Figure 7 – Participation and Marriage Rates, Females: Alberta 1966–1984

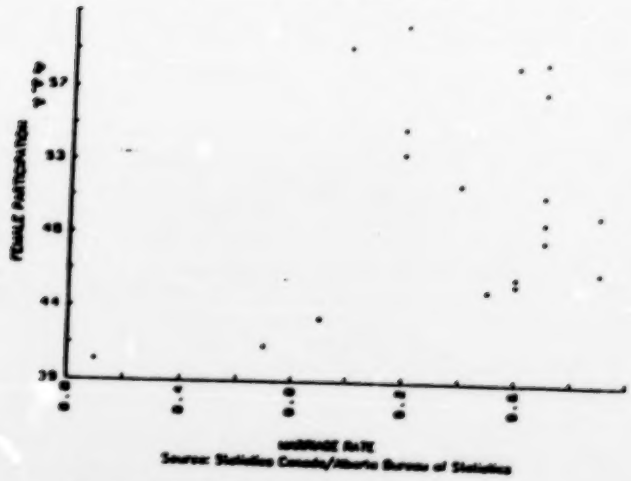


Figure 8 – Participation and Divorce Rates, Females: Alberta 1966–1984

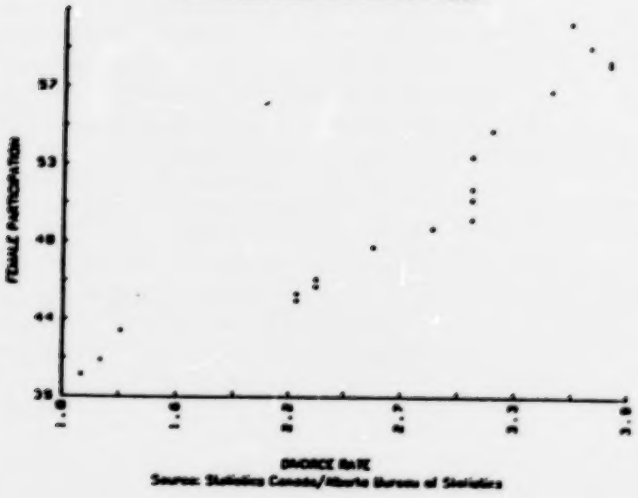
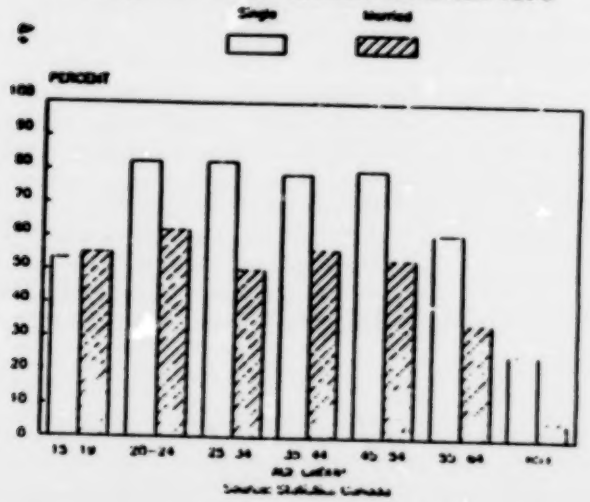


Figure 9
Participation Rate, Females: Edmonton 1976



and their non-labour income, the effect was especially strong after the threshold level of $9,000 (1971 $) For the United States, Mincer (1962) found that a $1,000 increase in husbands' income will reduce the labour force participation wives by 0.62 percent, assuming all things are equal. In addition a $1,000 increase in a woman's own income was estimated to increase her labour force participation rate by 1.33 percent. The substitution effect was thus estimated to be stronger than the income effect. On the other hand some, economists have found that the income effect has dominated the substitution effect (Robinson and Tomes 1985; and Nakamura and Nakamura 1985).

3.1.1.5 Social Factors

The increase in the labour force participation of women is attributed to a mixture of economic and social forces (Hammermesh and Rees 1984). The 1970's and 1980's have witnessed the rise of the women's movement which has sought to influence the political process by mobilizing public support for women's issues. The public and private sectors have responded by removing various economic and non-economic barriers against women in the work place resulting in better wages and more meaningful employment for women[11]. Canadian women are therefore developing a strong attachment to the labour force, since their reasons for working are no different from their male counterparts (Ciuriak and Sims 1980): to provide for their families and to fulfill personal goals. In Alberta the number of families headed by females increased from 27,215 in 1971 to 46,720 in 1981 or 71.67 percent. The trend in Edmonton was similar, where the number of lone parent families headed by females rose from 9,565 in 1971 to 14,765 in 1981 or by 54.37 percent (Table 3). In addition, marriage does not appear to be an attractive institution for many women. In 1966, Edmonton had a marriage rate of 10.0 per 1,000 population and this increased to 11.7 per 1,000 population by 1971 and then declined (with some fluctuation) to 10.1 by 1984. At the same time in Alberta the divorce rate increased from 1.1 per 1,000 in 1966 to 3.6 per 1,000 in 1984 (see Figure 8). Finally, in the case of two income families the wife's income could be an important factor in pushing the family income above the Canadian average (Statistics Canada 1984).

3.1.1.6 Age

If the 1976 census for Edmonton is classified by marital status and age, the labour force experience for married and single women between the ages of 20 and 54 years will be observed to be different (Figure 9). Single women, in that age group, have a relatively stable labour force participation rate, while married women exhibit a two phased working-life cycle. Married women in the rest of North America were found to behave in a similar fashion. Ostry and Zaidi (1972) explains this as follows: "...the typical Canadian woman marries earlier than before, works for some time after marriage until she starts a family and then drops out of the labour market to care for her children until they enter school". After age 64 the labour force participation rate for both married and single women drop sharply. This is accounted for by the availability of private and public pensions for individuals who are over 60 years old. In addition, declining participation may indicate a reduction in demand for their services (Addison and Siebert 1979).

TABLE 3

Number of Families and Lone Parent Families, Canada, Alberta, and Edmonton
(1971 - 1981)

	Year	Total Families	Lone Parent Families: Total	Male Parent	Female Parent	Female Parents % Increase
Canada	1971	5,070,685	470,605	99,785	370,820	-
	1976	5,727,895	559,335	94,990	464,345	25.23
	1981	6,324,975	713,815	124,390	589,435	26.94
Alberta	1971	382,115	33,845	6,630	27,215	-
	1976	448,765	41,195	6,640	34,560	26.99
	1981	565,635	56,885	10,165	46,720	35.19
Edmonton	1971	105,435	11,345	1,780	9,565	-
	1976	113,130	13,415	1,690	11,735	22.69
	1981	134,540	17,305	2,525	14,765	25.82

Source: The City of Edmonton, Social Services, Socio-Demographic Information Package. Edmonton, 1985.

Figure 10 – Calgary & Edmonton as a% of Alberta's Population & Male Participation

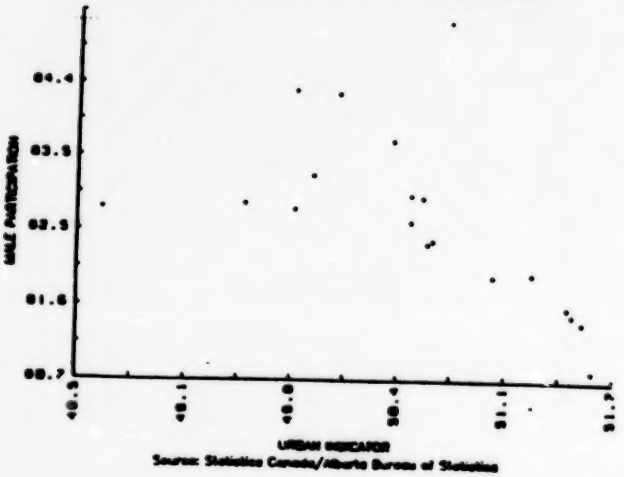
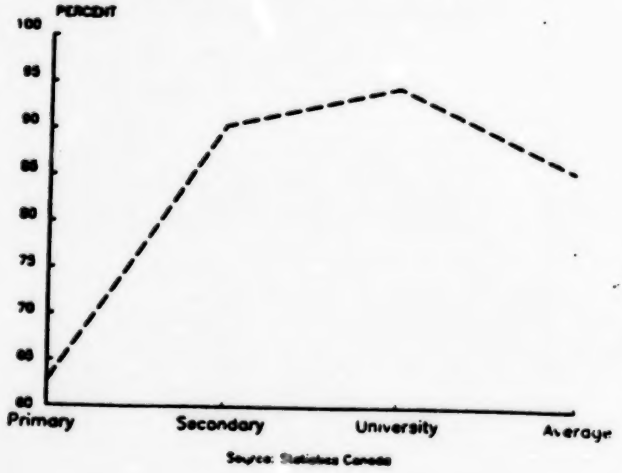


Figure 11 – Participation Rate by Years of Schooling, Males: Edmonton 1981



3.1.2 Men

The labour force participation rate for men in Alberta fluctuated between 82.4 and 82.6 percent between 1966 and 1984. With the increase of world oil prices and the subsequent economic boom (from 1973 to 1981), the labour force participation rate increased from 81.8 to 84.3 over that period. This development was also reflected at the City level where the male labour force participation rate for Edmonton was estimated at 83.00 and 84.98 percent in 1975 and 1981 respectively. The labour force behaviour for men in Edmonton and Alberta is in keeping with national and international trends. In 1975, Japan and Sweden had labour force participation rates of 81.4 and 77.0 percent and these declined to 78.9 and 73.0 percent, respectively, by 1984. Similarly, in the United States the labour force participation rate was 77.9 and 76.4 percent for 1975 and 1984, respectively (see appendix B).

The discussion that follows will examine the following topics: Urbanization, Family Income, Education and Age.

3.1.2.1 Urbanization

The change in the industrial structure of Alberta from an agrarian economy of the early 1900's (which depended on male manpower) to the highly industrialized economy of today (which utilizes both male and female labour) was a factor that has contributed to the withdrawal of the prime age male from the labour force (Peitchinis 1970). For example, on the farm tasks were performed by the farmer and his or her immediate family. As a result, it was not uncommon to find the very old or the very young performing farming related duties. The decline in the number of family farms resulted in the movement of families from the rural to the urban areas. The young members (of the displaced families) were now unable to compete in the urban industrialized job market because of inadequate education and job skills. In addition, the older members were disqualified from labour market tasks, because they were above or close to the (legal) retirement age (see Figure 10).

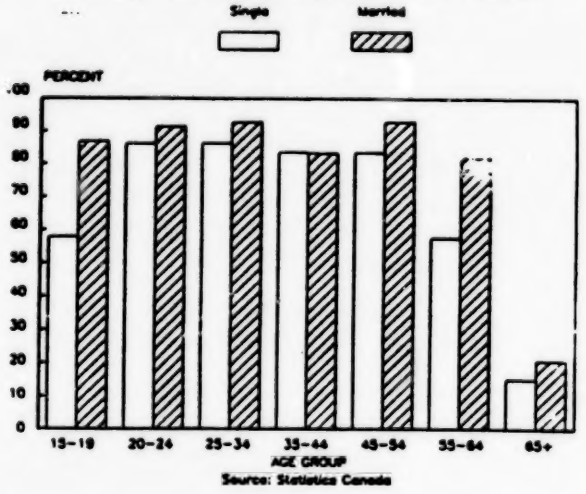
3.1.2.2 Family Income

The increasing labour force participation of women has resulted in a sharing of the financial burden in the husband and wife households. Because of the increase in the men's non-labour income, consumption of non-market activities is now more attractive and work is no longer the only activity of the prime age male. Peitchinis (1970) shows that increasing participation in education has occurred with reductions in the male labour force participation rate.

3.1.2.3 Education

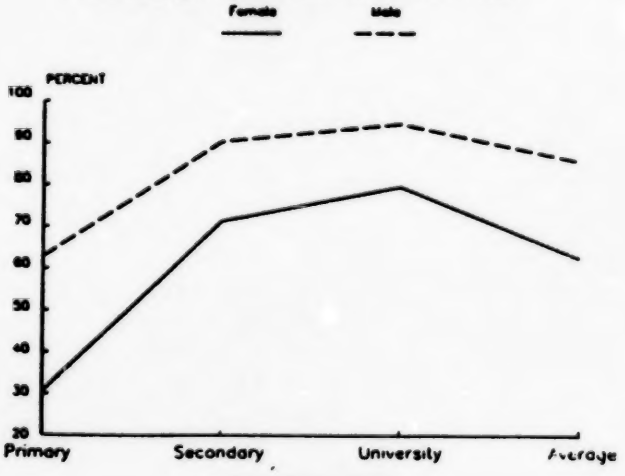
Like women, the labour force participation rate for men is directly related to their level of education. For example in 1981, the labour force participation rate for men in Edmonton with a University degree was 94.5 percent and for men with less than a grade 9 education, it was less than 62.7 percent (Figure 11).

Figure 12
Participation Rate, Males: Edmonton 1976



Source: Statistics Canada

Figure 13 – Participation Rate by Years of Schooling, Both Sexes: Edmonton 1981



Source: Statistics Canada

3.1.2.4 Age

The overall labour force participation rate masks the variation in rates among different age groups and marital status. In 1976 the LFPR in Edmonton ranged from 14.9 percent to a high of 92.8 percent. Married men between the ages of 20 and 54 years showed the strongest labour force attachment (see Figure 12). Their preference for labour market activities is largely explained by the increased financial obligation that comes with marriage and family formation. On the other hand single men tend to have an inverse relationship between age and labour force participation. For example, the LFPR for men increases between the ages of 15 and 24 years and then declines steadily afterwards. Commenting on a similar situation for the U.S. economy Hammermesh and Rees (1984) contend that these facts should not be interpreted as, being single causes a lower level of labour force participation, since the factors for non-labour market participation might have contributed to being single.

The LFPR for both single and married men falls sharply after 64 years. This can be attributed to the combination of rising non-market income and reduced labour demand for their services (Addison and Siebert 1979).

3.1.3 Both Sexes (Men and Women)

In this segment of the report, a comparison is made of the LFPR of males and females by level of education and age.

3.1.3.1 Education

Even though women and men in Alberta in general and Edmonton in particular share the same level of education their labour force experience is vastly different (Figure 13). In 1981, males and females with less than a grade 9 education had average labour force participation rates of 62.7 and 30.5 percent respectively. In addition, males and females with a University degree had labour force participation rates of 94.5 and 79.4 percent respectively. Hammermesh and Rees (1984) contend that the reasons for the difference in labour force participation lies in the current Western attitudes about responsibilities for domestic duties; as the wife is generally expected to bear most of the burden of child care and household maintenance.

3.1.3.2 Age

The LFPR for both males and females tend to be low at both ends of the working life cycle and then higher in the middle. For example, from age 15 to 19 years, education tends to be the major alternative to labour market activities. At the other end of the age spectrum, the LFPR begins to decline from age 55 years, as individuals avail themselves of early retirement benefits. The aggregate labour force tends to mask the influence of marital status and sex differences.

The 1976 LFPR for single males and females tended to be similar in both absolute and relative terms. In addition, the male and female life cycle

portrayed the same shape as the aggregate life cycle curve. Single men had a higher LFPR than single women until age 44 years. It is possible to explain this by arguing that single women because of historic discrimination earn less than men and hence possess a smaller amount of non-wage income. As a result, their demand for non-market activities is lower.

3.2 Time Series

Time series studies are generally based on aggregate data for a number of time periods[12]. As a result, changes in the labour force participation rate for a given group can be related to changes in various economic and social indicators[13],[14]. Economist contend that at any given unemployment rate there are two opposing forces that affect the labour force participation rate: (a) the discouraged work effect and (b) the added work effect (Mincer 1966).

I) Discouraged worker

An increase in the unemployment rate convinces the unemployed that their chances of obtaining employment are slim and as a consequence, they leave the work force, depressing the labour force participation rate.

II) Added worker

The unemployment of a member of the household generally results in other members of the household joining the labour force so as to maintain past levels of consumption.

Economic theory is therefore unable to decide on an a priori basis as to which one of these effects is dominant. An example of these problems is highlighted by the work of Dernburg and Strand (1964). Their specification of the labour force participation rate is represented by the following equation:

$$LFPR = a_0 + a_1(Z/P)_{t+2} + a_2(C/P)_t + a_3(1/P)_t + U_t$$

where $(Z/P)_{t+2}$ is the ratio of unemployed who have exhausted their unemployment benefits versus the adult population two months after t;

$(C/P)_t$ is the percentage of the adult population employed at month t; and

$(1/P)_t$ is the reciprocal of the adult population at month t.

The expected sign on the regression parameters are as follows: $a_1 > 0$, $a_2 > 0$ and $a_3 < 0$. Variations in Z/P are supposed to represent fluctuations in income opportunities and a positive sign on the regression parameter reflects the added worker effect. C/P represents changes in employment prospects and the forecasted sign on the regression parameter is expected to be positive reflecting the discouraged worker effect.

The following empirical results are obtained for the period 1953 - 1962[13]:

$$LFPR = a_0 + .9490\,(C/P)_t + 12.699\,(Z/P)_{t+2} - 5326.1\,(1/P)_t + U_t$$
$$\qquad\qquad (.0367) \qquad\qquad (.735) \qquad\qquad (695.4)$$
$$R^2 = 0.8766$$

The results appear to confirm the existence of the added and discouraged worker effect. However, Mincer (1966) points out that the model suffers from a number of problems including:

a) The results are difficult to interpret, as the estimated parameter on Z/P can lead one to conclude that the exhaustion of one benefit could cause at least 13 people to enter the labour force.

b) The model is almost tautological as the labour force participation rate LFPR and the newly unemployed population ratio are highly correlated.

In Alberta a time series model was developed for the province by Mansell and Wright (1977) and it has since been adapted to the Edmonton CMA (Huang 1987). The Mansell and Wright model is based on the following specifications:

$$Y = a_0 + a_1\,RDYPC_{t-1} + a_2\,AUNR_{t-1} + a_3\,FEM_t$$

Where Y = labour force participation rate
$RDYPC_{t-1}$ = real disposable income per capita for the previous period

$AUNR_{t-1}$ = unemployment rate of the previous year

FEM_t = fraction of the working age population that is female

The expected signs for the regression parameters is as follows: $a_1 > 0$ and $a_2 < 0$ and $a_3 > 0$. The above equation was estimated for the period 1961 - 1975 and it produced the following results:

$$y = 36.7441 - .3625\,AUNR_{t-1} + 1.3901\,RYPC_{t-1} + 84.0896\,FEM_t$$
$$\qquad (4.14) \quad (-2.90) \qquad\qquad (2.52) \qquad\qquad (2.01)$$
$$R^2 = .96 \quad DW = 2.13$$

The results appear to lend support to the discouraged worker hypothesis as a ten percentage point increase from the previous unemployment rate is expected to reduce the labour force participation rate by 3.6 percentage points. A $1,000 increase in the previous year's real disposable income per capita should produce a 1.39 percentage point increase in the labour force participation rate.

3.3 Conclusions from Empirical Analysis

a) Data

i) The labour force participation rate for Alberta women has increased steadily over the 1966 - 1984 period, rising from 40.28 percent in 1966 to 62.12 percent in 1986 or by 54.21 percent.

ii) The labour force participation rate for Alberta men declined between 1966 and 1972 and increased from 81.42 percent in 1972 to peak at 85.17 percent in 1981 and steadily declined each year to reach 82.10 percent in 1986. It should be noted that the increase in the male labour force participation rate has coincided with the (1973 - 1981) economic boom in Alberta.

b) Literature Review

The empirical literature addresses the question, why are there differences in the labour force participation rate among groups? The average labour force participation rate for men has been observed to be higher than that for women. Over the long run the difference in the two rates has been shrinking, since the participation rate for the males has been falling while that for females has been rising.

The women's links to the labour force are being fueled by a mixture of social and economic forces. The transformation of Alberta from a society that relies on agriculture to a service economy, has resulted in increased job opportunities for women. In addition society's attitudes towards the role of women in the work place and home has undergone a rapid transformation in the 1970's and 1980's. Unfortunately, most empirical studies have ignored the social factors as they are difficult to quantify and thus have concentrated instead on the more easily measured economic factors.

The labour force participation rate of married women is strongly influenced by the prevailing wage rate and negatively related to their husbands incomes and the presence of young children in the home.

The time series studies show that there is a link between the unemployment rate and the labour force participation rate. However, there is no agreement as to the nature of these ties as studies support both the added and discouraged worker hypotheses.

The labour force participation rate for men is affected by the shift in the population from the rural to the urban areas. The increased urbanization requires a greater degree of skill from would-be job seekers. As a consequence, the younger members of the work force are forced out of the job market. In addition, the older members of the work force are required to observe maximum age legislation, and this also pushes them out of the labour force.

The data from the industrialized countries show that a differential in labour force participation rate between male and female exists in all countries. There are several reasons for this including difference in tastes (attitudes) towards work. The lesson that has been learnt from the review is that as society liberalizes its attitudes towards women, the male/female differential is likely to shrink. The labour force participation of men is likely to continue its decline as women share the financial burden of running the home and the male/female wage differential disappears in the work place. On the other hand, women will likely increase their labour force participation as working conditions, wage rates and educational standard improve. Changes in the overall participation will depend on the net outcome.

4. SPECIFICATIONS OF EQUATIONS FOR LOCAL LABOUR MARKETS

This section presents the results of regression analyses of labour force participation rate on a number of explanatory variables, that were identified in Section 3 of this report. The equations with the higher R^2s and the lower Standard Error of Estimates were judged to possess the greater explanatory power.

Two alternative specifications are presented since they represent different ways of estimating labour market conditions. Alternative II represents the status quo as this specification is included in the Edmonton Econometric Model (Huang 1987). This formulation is adjusted by estimating separate equations for males and females and labour market conditions are estimated by the unemployment rate. Alternative I uses the percent change in employment to measure job availability(16).

The data indicates that the labour force participation rates for men and women has been moving in different directions and as a result, it is necessary to specify separate equations to capture this behaviour. In the sections that follow equations for Alberta and Edmonton will be estimated.

4.1 Alberta

4.1.1 Alternative I

In this section a number of propositions are presented for men and women separately.

4.1.1.1 Men

1. People participate in the labour market because jobs are available. Their perceptions of labour market conditions are influenced by information on one or a number of economic factors: employment, growth in employment, the unemployment rate and growth of the overall economy product.

   In this analysis labour market conditions are represented by growth in employment (CHEMP). As more jobs become available the labour force participation rate is expected to increase. The sign on the regression coefficient is expected to be positive.

2. The transformation of the province from an agrarian to an industrial economy was accompanied by a shift in the population from the rural to the urban areas. The shift to industrial activity required a new set of job skills from the population. As a result, some members of the labour force were forced to withdraw from the labour market because of their inability to meet these requirements.

   In this analysis, urbanization (URBAN) is represented by the proportion of the provincial population that reside in Edmonton and

Calgary[17]. The sign on the regression parameter is expected to be negative.

3. The labour force participation rate for men has been relatively stable over the period 1966 - 1986. This trend will be approximated by the previous years labour force participation rate (LABPRMAL).

The above relationships are represented by the following equation:

$$LABPRMA = a_0 + a_1 CHEMP + a_2 URBAN + a_3 LABPRMAL$$

The expected signs on the regression coefficients are as follows:

$a_1 > 0$, $a_2 < 0$ and $a_3 > 0$

Estimating this equation by ordinary least squares[18] and then correcting for auto correlation, yields the following results:

$$LABPRMA = \underset{(2.78)}{51.675} + \underset{(16.12)}{.12929\ CHEMP} - \underset{(4.47)}{.52086\ URBAN} + \underset{(6.12)}{.6889\ LABPRMAL}$$

$R^2 = .9407$ DW = 2.25 S.E.E. = .301 RH0 = - .52

The estimated coefficients are statistically significant at the one percent level and the R^2(.9407) indicates a good overall fit. The signs on the regression coefficient are in keeping with expectations. A one percentage point increase in employment is expected to have a .13 percentage point increase in the labour force participation rate, assuming all things are equal. In addition, a one percentage point increase in the urban population may produce a reduction in the labour force participation rate of .52 percentage point.

4.1.1.2 Women

1. Women are working for the same reasons as men: to take care of themselves, their families and to satisfy personal goals. As a result, an increase in job opportunities would act as an incentive to attract them to the labour force. Increased job opportunities are estimated by the growth in employment (CHEMP). The correlation between change in employment and the female labour force participation is expected to be positive.

2. The current wage rate (ALWAGE) acts as an inducement for the would be job seeker. The higher the wage rate, the greater would be the labour force participation rate. The expected sign on the regression parameter is positive.

3. Over the period 1966 - 1984, the labour force participation has been increasing. This trend will be captured by using the previous years participation rate (LABPRAWL).

The above relationships can be represented by the following equation:

$$LABPRAW = a_0 + a_1 CHEMP + a_2 ALWAGE + a_3 LABPRAWL$$

where $a_1 > 0$, $a_2 > 0$ and $a_3 > 0$

Estimating this equation by ordinary least squares and then correcting for auto-correlation yield the following results for Alberta:

$$LABPRAW = \underset{}{22.092} + \underset{(3.84)}{.2564CHEMP} + \underset{(5.30)}{.028419ALWAGE} + \underset{(3.94)}{.4178LABPRAWL}$$
$$\qquad\qquad\qquad

Estimating the above equation yield the following results:

$$\text{LABPRMA} = 78.625 - .23852\ \text{UNEMPRAL} + .63092\ \text{RDYPCL}$$
$$(94.2973)(-3.77043) \qquad (5.95205)$$

$R^2 = .7973$ DW = 1.8871 S.E.E. = .521 RH0 = .23

The results appear to confirm the discouraged worker hypothesis. A ten percentage point increase in the previous year's unemployment rate is expected to reduce the labour force participation rate by 2.3 percentage points. In addition a $1,000 increase in the previous periods real disposable income per capita should produce a 0.63 percentage point increase in the labour force participation rate.

4.1.2.2 Women

1. An increase in the unemployment rate will result in an increase in the female labour force participation rate, as secondary workers attempt to maintain the family's past living standards. The expected sign on the regression parameter is positive.

2. Over the last two decades, women in Alberta have increased their labour force participation. Mansell and Wright (1977) contend that this was due to a mixture of social, technological and economic factors and that over the years these forces have created attractive labour market conditions for women. These conditions are represented by real disposable income per capita lagged (RDYPCL). The expected sign on the regression parameter is positive.

The above relationships are expressed by the following regression equation:

$$\text{LABPRAW} = a_0 + a_1\ \text{UNEMPRAL} + a_2\ \text{RDYPCL}$$

where $a_1 > 0, a_2 > 0$

Estimating the above equation yield the following results:

$$\text{LABPRAW} = 23.147 + .58649\ \text{UNEMPRAL} + 3.14\ \text{RDYPCL}$$
$$(7.72) \quad (4.25) \qquad (9.53)$$

$R^2 = .9841$ DW = 1.50 SEE = .863 RH0 = .64

The results appear to confirm the added worker hypothesis. A one percentage point increase in the previous period's unemployment rate should produce an increase in the labour force participation rate of about .58 percentage point. A thousand dollar increase in the previous year's real disposable income per capita should increase the labour force participation rate by 3.14 percentage points.

4.2 Edmonton

Data was not available on male and female labour force activity prior to 1975, and as a result separate equations for each sex are not estimated. The equations are based on Alternative I as Alternative II was estimated by Huang (1986).

The aggregate empirical equation is based on the following propositions:

1. Labour force participation by the local residents is influenced by changes in total provincial employment (CHEMP). It is assumed that increased employment would induce added labour force participation; the sign on the regression parameter is therefore expected to be positive.

2. An increase in the provincial wage rate (ALWAGE) would provide the financial incentive for secondary workers to enter the job market. The statistical correlation between wage rate and labour force participation is expected to be positive[18].

3. A dummy variable (DUMMY) is introduced into the model to control for the break in the data series. The values for this variable (between 1966 to 1974) are zero and (from 1975 to 1986) one.

The equation for the overall labour force participation rate is as follows:

$$LABPRE = a_0 + a_1\,CHEMP + a_2\,ALWAGE + a_3\,DUMMY$$

The expected signs are as follows: $a_1 > 0$, $a_2 > 0$ and $a_3 > 0$

Estimating the above equation and correcting for auto-correlation, yielded the following results:

$$\underset{\quad\ (51.51)\ \ (4.44)\qquad\qquad (2.15)\qquad\qquad (3.39)}{LABPRE = 59.95 + 0.18\,ALWAGE + .236\,CHEMP + 3.47\,DUMMY}$$

$R^2 = .9515$ DW = 1.83 S.E.E = .996 RH0 = .38

The signs on the estimated equations are in keeping with prior expectations. An increase of ten dollars to the average provincial wage rate should produce a 1.8 percentage point increase to the labour force participation rate. A ten percentage point increase in provincial employment growth may result in a 2.36 percentage point increase in the labour force participation rate. Finally, the sign on the dummy parameter shows that the break in the data series resulted in an increase of 3.47 percentage points in the labour force participation rate.

4.3 Summary

Results from the empirical analyses are summarized in the following tables:

Summary Statistics - Alberta
Alternative I

	Men		Women	
Variable	Coefficient	T-Values	Coefficient	T-Values
COEFFICIENT	51.675	2.78	22.092	3.84
ALWAGE	-	-	.028419	3.94
CHEMP	.12929	16.12	.2564	5.30
URBAN	-.52086	4.47	-	-
LABPRMAL/AWL	.6889	6.12	.4178	2.75
R^2	.9407	-	.9951	-
D.W.	2.25	-	2.03	-
S.E.E.	.301	-	.476	-

Summary Statistics - Alberta
Alternative II

	Men		Women	
Variable	Coefficient	T-Values	Coefficient	T-Values
COEFFICIENT	78.625	94.30	23.147	7.72
UNEMPRAL	-.23852	-3.77	.58649	4.25
RDYPCL	.63092	5.95	3.14	9.53
R^2	.7973	-	.9841	-
D.W.	1.89	-	1.50	-
S.E.E.	.521	-	.863	-

5. SIMULATION RESULTS

Two sets of empirical equations were specified and tested for Edmonton and Alberta: Alternative I and Alternative II. The regression statistics shows that Alternative I provides a better explanation of the data, as the R^2s are higher and the standard error of estimates are lower than Alternative II. The equations from alternative I were therefore integrated into the Edmonton Econometric Model (Huang 1987) for the purpose of this simulation.

The objective of the simulation is to assess the impact of Alternative I equations on the forecasted provincial and local labour supply. The simulation (for the period 1986 - 1992) is based on a number of assumptions that are listed in Table 4.

The impact of Alternative I is measured by comparing the results from these equations against those from Huang (1987). Results from Huang (1987) will be referred to as "base" and the output from Alternative I as "Alt I".

The labour force participation rate in Alberta is forecasted to increase under both scenarios, rising from between 72.09 and 72.07 percent in 1986 to 74.45 and 73.94 percent in 1992. In Edmonton, the LFPR also increases under both scenarios climbing from between 72.08 and 71.57 percent in 1986 to 74.05 percent in 1992. These results are in keeping with forecasts from the Conference Board of Canada. The Board forecasts the Alberta LFPR to rise from 73.0 percent in the fourth quarter of 1986 to 75.1 percent in the fourth quarter of 1991.

The implication for the local labour market is that, the labour force is expected to increase in each year of the 1986-1992 period. The Edmonton labour force is forecasted to climb from between 409,960 and 402,400 persons in 1986 to 466,900 and 458,080 persons in 1992. The unemployment rate in the Edmonton and Alberta is forecasted to increase throughout the forecast period as the rate of job creation is expected to fall short of the growth rate in the labour force.

TABLE 4

Economic Assumptions

Year	Alberta Net Migration (000)	Interest Rate %	Growth of Canadian GNP %	Canadian Unemployment Rate %	World Oil Price $	Percentage of Provincial Population in Edmonton $ Calgary (%)
1986	-16.4	10.5	3.10	9.6	15.07	50.5
1987	-4.0	9.5	2.50	9.3	19.00	50.5
1988	3.0	9.5	3.00	9.1	22.00	50.5
1989	8.0	9.25	3.00	8.9	24.00	50.5
1990	10.0	9.00	3.00	8.7	26.00	50.5
1991	15.0	8.75	3.00	8.5	27.00	50.5
1992	15.0	8.50	3.00	8.3	28.00	50.5

Source: Corporate Forecasting Group, Planning and Building Department March 1987

TABLE 5

Labour Force Participation Rate

	Edmonton		Alberta		
Year	Alt I	Base	Alt I	Base	Board
1986	72.08	71.57	72.09	72.07	72.1
1987	72.21	71.90	72.27	72.19	72.3
1988	72.47	72.28	72.44	72.48	72.8
1989	72.81	72.63	72.80	72.81	72.8
1990	73.19	73.04	73.30	73.17	73.3
1991	73.62	73.52	73.89	73.55	74.4
1992	74.05	74.05	74.45	73.94	N/A

Source: 1) Corporate Forecasting Group, Planning and Building Department, March 1987.

2) Conference Board of Canada. Provincial Forecast. April 1987.

TABLE 6

Labour Force

	Edmonton		Alberta	
Year	Alt I	Base	Alt I	Base
1986	409.96	402.43	1268.60	1267.60
1987	415.90	408.72	1288.42	1286.52
1988	423.16	416.64	1311.80	1312.12
1989	433.16	425.50	1341.55	1341.65
1990	443.54	435.17	1375.84	1373.72
1991	455.10	446.38	1516.66	1410.61
1992	466.90	458.08	1458.11	1448.69

Source: Corporate Forecasting Group, Planning and Building Department, March 1987.

TABLE 7

Unemployment Rate

	Edmonton		Alberta	
Year	**Alt I**	**Base**	**Alt I**	**Base**
1986	11.38	11.52	9.82	9.79
1987	11.70	12.13	10.26	10.17
1988	12.66	12.85	11.05	10.76
1989	13.40	13.40	11.75	11.24
1990	13.79	13.75	12.17	11.53
1991	13.93	13.94	12.33	11.72
1992	14.04	14.08	12.35	11.84

Source: Corporate Forecasting Group, Planning and Building Department, March 1987.

6. CONCLUSIONS

6.1 Labour Market Developments

Local and provincial labour market developments are in keeping with national and international trends for both males and females. The labour force participation rate for women in Alberta has increased steadily over the 1966-1984 period, rising from 40.28 percent in 1966 to 62.12 percent in 1986; thus matching changes at the international level. The labour force participation rate for men in Alberta has been relatively stable over the 1966-1984 period. This male LFPR increased with the economic boom and declined with the on-set of the current recession (1981-87). If the economic boom of 1973-1981 period is discounted, the LFPR for men in Alberta would confirm to national and international trends.

6.2 Forecasted Participation Rates

The average labour force participation rate is expected to increase in each year of the 1986-1992 period. In Alt.I, the LFPR for Alberta is forecasted to increase from 72.09 percent in 1986 to 74.45 percent in 1992. Similarly, in the base case (Huang 1987) the LFPR is expected to climb to 73.94 percent in 1992 from 72.07 percent in 1986. The forecast of increased labour force participation appears to be reasonable as the Conference Board (April 1987) predicts that the LFPR for Alberta will rise from 73.0 percent in the fourth quarter of 1986 to 75.1 percent in the fourth quarter of 1991. It can therefore be concluded with some certainty that the LFPR will increase in each year of the 1986-1992 forecast period.

6.3 Empirical Equations

The labour force participation rates for men and women have exhibited opposing trends and as a result, separate equations were specified for each sex. In addition alternative specifications are estimated. Alternative I provided the better the explanation of the data, for the 1966-1984 period, as it had higher R^2s and lower Standard Error of Estimates. The empirical equations are based on the following propositions:

6.3.1 Men

The male labour force participation rate is explained by growth in employment, the fraction of the provincial population that resides in Edmonton and Calgary, and the male lagged labour force participation rate.

The estimated equation is as follows:

LABPRMA = 51.675 + .12929 CHEMP - .52086 URBAN + .6889 LABPRMAL

6.3.2 Women

The female labour force participation rate is influenced by the growth in employment, the average provincial wage rate and the female lagged labour force participation rate.

The estimated equation is as follows:

LABPRAW = 22.092 + .2564CHEMP + .028419ALWAGE + .4178LABPRAWL

6.4 Simulation Results

Huang (1987) expects the Alberta LFPR to increase from 72.07 percent in 1986 to 73.55 percent in 1991.

The Conference Board of Canada's (April 1987) provincial forecast predicts that the provincial LFPR will grow from 72.1 percent in 1986 to 74.4 percent in 1991.

The current study (Walters 1987) forecasts the Alberta LFPR to climb to 73.9 percent in 1991 from the 1986 level of 72.09 percent.

These forecasts all indicate an upward trend for the LFPR over the short run and as a result, it can be stated with some confidence that the labour force will increase over the review period, assuming all things are equal.

6.5 Recommendations

Further research should be undertaken to understand the factors that influence job creation in Alberta and Edmonton. The work that is being undertaken by Ford (1987) in this area should be encouraged.

The Corporate Forecasting Group is currently developing plans to: (a) gather and analyze data on employment by geographic in Edmonton and (b) refining the employment component of the Edmonton Econometric Model. These projects when completed would provide detailed and current information to the private and public sectors.

Manpower policies should be designed to ensure that the local labour market operates in a more efficient manner. For example, the various levels of government and universities should be encouraged to set up a manpower/economic think tank to provide ideas for local development.

Notes

1. Edmonton is used to refer to the Edmonton Census Metropolitan Area. In the report Edmonton, City of Edmonton and Edmonton C.M.A. all refer to the Edmonton C.M.A.

2. The labour force participation is a special case of the labour supply decision, see discussion in Hammermesh, D and A. Rees, The Economics of Work and Pay, 3rd; New York, Harper & Row, Publishers 1984.

3. See Becker, G. "A Theory of the Allocation of Time," in Burton et al ed. Reading in Labour Market Analysis, New York, Holt, Rinehart and Winston Inc. 1971.

4. The labour force participation rate is defined as the percentage of the working age population that is actively seeking employment. In symbolic terms this is expressed as:

$$LFPR = \frac{LF}{POP15} * 100$$

where LF refers to the labour force and POP15 is the non-institutional population that is over fifteen years old.

5. The labour force participation behaviour for single women is similar to that for single and married men. A possible explanation is that they work for the same reasons: to fulfill personal and social goals.

6. For a discussion on the Canadian economy see Nakamura, A and M. Nakamura, "A Survey of Research on the Work Behaviour of Canadian Women", M. C. Riddell ed, Work and Pay: The Canadian Labour Market, Toronto, University of Toronto Press, 1986.

7. The educated are also attracted to the labour market because they are able to secure more interesting work assignments.

8. Some economists have used fertility as an explanatory variable for labour force participation rate, see Thomas T. Schweitzer, Migration and a Small Long Term Econometric Model of Alberta, Ottawa, Economic Council of Canada, 1982, Discussion Paper 221.

9. Several reasons may be advanced for the weakened correlation between fertility and labour force participation:

   a) Day Care Facilities

      As more women entered the labour force in the 1960's and 1970's more day care facilities became available. This result in the reduction of the cost of non-market time.

b) Other Factors

As women became more educated, the opportunity cost for non-market tasks increased and as a result their labour force participation rate increased. In addition, an educated is much better able to organize her non-market time (Hammermesh and Rees 1984).

10. Non labour may include spouses income and income from assets.

11. In Alberta the government has responded to women's aspirations by establishing the Women's Secretariat.

12. Times series data on various Sub-groups is not available.

13. Another form of time series analysis is trend extrapolation, which uses regression analysis to estimate past rates of change in participation. The dependent variable is the labour force participation rate and the independent variable is time. This form of analysis has been used by the United States, Bureau of Labour Statistics to forecast labour force participation rates for both sexes.

Ryscavage (1979) points out that this technique has constantly underestimated the female participation rate and over estimated the male participation rate. These problems were caused by a number of factors:

a) Tapering

The forecasted rates were adjusted to prevent them from falling outside pre-specified limits.

b) Test Period

The selection of a test period to develop estimates for the regression parameters is a crucial factor in developing forecasts as longer time series masks sharper short term growth, while shorter series highlights rapid growth. For example the female participation rate had been increasing at an increasing rate in the mid 1970's hence any trend extrapolation would tend to produce an underestimate of future rates.

c) Take Off Points

The forecaster when using trend extrapolation must decide on where the extrapolation should begin:

i) last observation, or
ii the average of the most recent periods

See: Ryscavage, P.M. "BLS labour force projections: a review of methods and results." Monthly Labour Review, April 1979.

14. Time series analysis of labour force participation is not very popular among economists, since many of the explanatory variables (that have been identified in cross section analysis) are highly correlated. As a result the analyst's choice variable is restricted.

    See: a) Officer, L.H. and P.R. Andersen. "Labor Force Participation in Canada", Canadian Journal of Economics 1969.

    b) Wachter, M.L. "A Labor Supply Model for Secondary Workers", The Review of Economics and Statistics, May 1972.

15. The study was based on quarterly data.

16. The percent change in employment was regressed against the percent change in the unemployment rate. The unemployment rate was the dependent variable. This regression produced an R^2 of .4125.

17. The population of Edmonton and Calgary are used to represent urbanization in the province; as it is assumed, in the study that, urban areas are mainly involved in non-agricultural tasks.

18. Morley Gunderson (1977) contends that there are no dramatic difference between logit results and regression results. In addition his reasons for using the logit technique was to "...account for the statistical problems associated with dichotomous dependent variables. Such problems frequently occur when labour force participation equations are estimated from micro data where the individual is the unit of observation." P454.

    Several of Alberta's smaller town and villages serve as the service centres for the agricultural industry. It is therefore possible to find people who live in those smaller cities and towns who engage in agricultural tasks.

19. The Edmonton equations uses provincial values for wage rate (ALWAGE) and change in employment (CHEMP). This is in recognition of the fact that residents of the study area (Edmonton C.M.A.) may be employed outside of the area.

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APPENDIX A

Equations for Labour Force Participation

1. MEN

$$\begin{aligned} LABPRMA &= 51.675 + .6889 * LABPRMAL + .12929 * CHEMP \\ &\quad (2.78) \quad (6.12) \quad (16.12) \\ &\quad -.52086 * URBAN - .032928 * (LABPRMA(-1) - \\ &\quad (4.47) \\ &\quad (51.675 + .68887 * LABPRMAL(-1) + .12929 * \\ &\quad CHEMP(-1)) \end{aligned}$$

$R^2 = .9407$ D.W = 2.25 S.E.E = .301

2. WOMEN

$$\begin{aligned} LABPRAW &= 22.092 + .4178 * LABPRAWL + .2564 * CHEMP \\ &\quad (3.84) \quad (2.75) \quad (5.30) \\ &\quad + .028419 * ALWAGE + .10972 * (LABPRAW(-1) \\ &\quad (3.94) \\ &\quad -(22.092 + .4178 * LABPRAWL(-1) + .2564 * \\ &\quad CHEMP(-1) + .028419 * ALWAGE(-1))) \end{aligned}$$

$R^2 = .9951$ DW = 2.03 SEE = .476

3. $LABPRMAL = LABPRMA(-1)$

4. $LABPRAWL = LABPRAW(-1)$

5. $CHEMP = (EMPLA/EMPLA(-1) - 1) * 100$

6. $LFPR = (LABPRAW*POPISW + LABPRMA*POPISM)/(POPISW + POPISM)$

RESULTS

LABPRAW

YEAR	1 Actual	2 Estimate	3 Residual	4 % Error $\frac{1-2}{2} \cdot 100$
1968	42.9	43.3	-0.4	-0.93
1969	44.7	44.5	0.2	0.45
1970	45.5	44.9	0.6	1.34
1971	45.1	45.5	-0.4	-0.88
1972	45.9	46.3	-0.4	-0.87
1973	47.9	47.2	0.7	1.49
1974	49.0	48.9	0.1	0.21
1975	49.5	49.6	-0.1	-0.21
1976	50.7	51.1	-0.4	-0.79
1977	51.3	52.0	-1.10	-2.12
1978	53.2	53.0	-0.20	0.38
1979	54.7	55.0	-0.30	-0.55
1980	57.1	56.5	0.60	1.07
1981	59.0	58.8	0.20	0.34
1982	58.7	58.7	0.00	0.00
1983	59.8	59.5	0.30	0.51
1984	61.2	60.0	0.30	0.50
1985	61.1	61.8	-0.70	-1.14

LABPRMA

YEAR	1 Actual	2 Estimate	3 Residual (1-2)	4 % Error $\frac{1-2}{2} * 100$
1968	82.4	82.6	-0.2	-0.25
1969	82.0	82.3	-0.3	-0.37
1970	81.5	81.6	-0.1	-0.13
1971	80.8	81.2	-0.4	-0.50
1972	81.4	80.9	0.5	0.62
1973	81.6	81.6	0.0	0.00
1974	82.0	82.0	0.0	0.00
1975	82.4	82.2	0.2	0.25
1976	83.0	82.9	0.1	0.12
1977	82.8	83.1	-0.3	-0.37
1978	83.2	83.6	-0.4	-0.48
1979	84.3	84.0	0.3	0.36
1980	84.3	84.6	-0.3	0.36
1981	85.2	84.7	0.5	0.59
1982	83.7	83.7	0.0	0.00
1983	83.0	82.9	0.1	0.12
1984	82.7	82.5	0.2	0.25
1985	82.5	82.4	0.1	0.13

LFPR

YEAR	1 Actual	2 Estimate	3 Residual (1-2)	4 % Error $\frac{1-2}{2} * 100$
1968	62.8	62.9	-0.1	-0.16
1969	63.5	63.4	0.1	0.16
1970	63.6	63.3	-0.2	-0.32
1971	63.1	63.3	-0.2	-0.32
1972	63.8	63.6	0.2	0.32
1973	64.9	64.4	0.5	0.78
1974	65.6	65.4	0.2	0.31
1975	66.1	65.9	0.2	0.31
1976	66.9	67.0	-0.1	-0.15
1977	67.2	67.6	-0.4	-0.60
1978	68.4	68.3	0.1	0.15
1979	69.7	69.5	0.2	0.29
1980	70.9	70.5	0.4	0.57
1981	72.3	71.8	0.5	0.70
1982	71.4	71.2	0.2	0.28
1983	71.6	71.2	0.4	0.57
1984	72.1	71.7	0.5	0.70
1985	71.9	72.1	-0.2	-0.28

APPENDIX B

TABLE B1

Canadian Labour Force Estimates 1966 - 1984

Year	Population 15 Plus (000)	Labour Force (000)	Labour Force Participation Rate (%)
1966	13,083	7,493	57.3
1967	13,444	7,747	57.6
1968	13,805	7,951	57.6
1969	14,162	8,194	59.9
1970	14,528	8,395	57.8
1971	14,872	8,639	58.1
1972	15,186	8,897	58.6
1973	15,526	9,276	59.7
1974	15,924	9,639	60.5
1975	16,323	9,974	61.1
1976	16,701	10,203	61.1
1977	17,051	10,500	61.6
1978	17,377	10,895	62.7
1979	17,702	11,231	63.4
1980	18,053	11,573	64.1
1981	18,375	11,904	64.8
1982	18,664	11,958	64.1
1983	18,917	12,183	64.4
1984	19,148	12,399	64.8

Source: Statistics Canada, Canadian Social Trends, Autumn 1986

TABLE B2

Labour Force Participation Rate

Year	Edmonton CMA			Alberta		
	Male	Female	Total	Male	Female	Total
1966			61.28	82.81	40.28	61.65
1967			62.31	82.87	41.14	61.81
1968			63.31	82.38	42.90	62.76
1969			61.95	82.01	44.70	63.47
1970			62.10	81.51	45.54	63.65
1971			63.44	80.82	45.10	63.09
1972			63.35	81.42	45.96	63.82
1973			64.69	81.60	47.87	64.87
1974			64.69	81.98	48.99	65.63
1975	83.00	54.07	68.22	82.42	49.51	66.98
1976	82.78	55.71	69.21	82.95	50.70	66.95
1977	82.86	52.17	67.63	82.80	51.32	67.20
1978	82.57	56.82	69.63	83.22	53.24	68.41
1979	83.33	58.67	71.08	84.25	54.79	69.73
1980	83.40	60.83	72.14	84.29	57.14	70.93
1981	84.98	62.65	73.90	85.17	58.97	72.30
1982	83.27	61.96	72.78	83.66	58.72	71.58
1983	82.33	60.31	71.40	82.98	59.79	71.58
1984	82.80	63.74	72.85	82.65	61.19	72.07

Source:

1. Statistics Canada, Historical Labour Force Statistics - actual data, seasonal factors, seasonally adjusted data. Catalogue 71 - 201
2. Statistics Canada, Telephone Conversation, March 1987
3. Corporate Forecasting Group, Planning and Building Department. City of Edmonton.

TABLE B3

Labour Force Participation Rates - Edmonton

Age Group (Years)		Single		Married	
		Male	Female	Male	Female
15 - 19	1971	53.41	46.95	79.60	48.36
	1976	57.8	53.2	86.7	55.0
20 - 24	1971	88.01	86.67	95.71	59.01
	1976	86.0	82.2	91.2	61.7
25 - 34	1971	90.29	85.46	96.97	43.00
	1976	86.1	82.2	92.6	49.9
35 - 44	1971	84.31	84.54	97.42	46.82
	1976	83.4	78.5	83.1	56.0
45 - 54	1971	78.43	82.36	95.84	48.57
	1976	83.3	79.7	92.8	53.1
55 - 64	1971	64.89	71.24	87.95	34.13
	1976	57.5	60.9	81.9	34.3
65 years and over	1971	13.19	24.87	25.95	6.74
	1976	14.9	25.4	20.6	5.6
Average	1971	69.27	62.91	89.36	44.44
	1976	71.5	65.6	84.8	49.2

Source: Statistics Canada, Census 1971, 1976

TABLE B4

Labour Force Participation Rate by Years of Schooling - Alberta

Schooling	1975	1976	1977	1978	1979	1980	1981	1982	1983
0 - 8 Years	49.4	49.3	48.5	46.7	47.9	47.5	48.0	46.4	45.8
High School	66.4	67.7	67.5	69.5	71.0	72.1	73.1	71.8	71.8
Some Post Secondary	69.8	72.3	72.4	73.9	75.2	76.8	76.9	74.6	73.3
Post Secondary Certificate	76.1	73.8	75.1	75.9	76.7	78.9	80.8	82.7	81.9
University Degree	82.4	84.4	82.8	83.5	84.5	85.7	86.9	85.8	87.6
Overall Rate	66.1	67.0	67.2	68.4	69.7	70.9	72.3	71.4	71.6

Statistics Canada, The Labour force Annual Averages. Cat #71-529

TABLE B5

Labour Force Participation Rates
Edmonton - 1981

Level of Schooling	Male	Female	Total
Total	85.6	62.4	74.1
Less than Grade 9	62.7	30.5	45.5
Grades 9 - 13 without diploma	78.7	54.7	66.2
Grades 9 - 13 diploma	90.3	71.2	79.1
Trades Certificate	91.6	70.3	85.1
Some University	91.3	70.3	81.3
University Certificate	94.0	73.6	81.8
University degree	94.5	79.4	88.4

Source: Statistics Canada, Census 1981, Cat 93-969

TABLE B6

Birth, Marriage and Divorce Rate per 1,000 Population, Alberta

Year	Birth Rate	Marriage Rate	Divorce Rate
1966	20.7	8.1	1.1
1967	20.6	8.7	1.2
1968	19.8	8.9	1.3
1969	19.8	9.5	2.2
1970	20.0	9.6	2.3
1971	18.8	9.6	2.2
1972	17.7	9.9	2.3
1973	17.4	9.7	2.6
1974	17.4	9.7	2.9
1975	17.8	9.9	3.1
1976	18.0	9.7	3.1
1977	18.0	9.4	3.1
1978	17.8	9.2	3.1
1979	18.0	9.2	3.2
1980	18.6	9.7	3.5
1981	19.1	9.7	3.8
1982	17.8	9.6	3.8
1983	19.4	9.0	3.7
1984	18.7	9.2	3.6

Source: Alberta Bureau of Statistics, Alberta Statistical Review

TABLE B7

Birth, Marriage and Divorce Rates per 1,000 Population, Edmonton

Year	Birth Rate	Marriage Rate
1966	22.0	10.0
1967	21.7	10.5
1968	21.0	10.8
1969	20.9	11.4
1970	21.1	11.5
1971	19.6	11.7
1972	17.6	11.3
1973	17.5	11.2
1974	16.6	10.9
1975	17.4	11.5
1976	17.4	11.5
1977	17.1	11.1
1978	16.8	10.8
1979	17.2	10.6
1980	17.9	11.3
1981	18.7	11.0
1982	19.5	11.0
1983	19.5	10.1
1984	18.7	10.1

Source: The City of Edmonton, Social Services, Socio-Demographic Information Package. Edmonton, 1985

TABLE B8

Labour force participation rates and the relative shares of employment and unemployment to changes in the labour force participation of men and women six countries, 1975 and 1984.

	Labour force participation rate			Employment Population ratio		Percentage point change in the		
	1975	1984	1984 using 1975 weights	1975	1984	participation rate	population ratio	population ratio
Men:								
Australia	80.5	75.7	80.2	77.7	69.1	-4.8	8.6	3.8
Canada	78.4	76.6	79.1	73.5	68.0	-1.8	-5.5	3.7
Japan	81.4	78.9	80.8	79.8	76.8	-2.5	-3.0	0.5
Sweden								
Unadjusted	80.0	76.3	79.8	78.9	74.0	-3.7	-4.9	1.2
BLS adjusted[3]	77.0	73.0	76.4	(2)	(2)	-4.0	(2)	(2)
United States	77.9	76.4	78.4	71.7	70.7	-1.5	-1.9	-0.5
West Germany[4]	74.5	71.9	76.2	72.1	67.4	-2.6	-4.7	2.1
Women:								
Australia	43.0	44.6	41.3	40.3	40.9	1.6	0.5	1.0
Canada	44.4	53.5	43.7	40.8	47.3	9.1	6.5	2.6
Japan	45.7	49.0	44.1	45.0	47.6	3.3	2.6	0.7
Sweden:								
Unadjusted	59.2	67.5	59.4	58.0	65.3	8.3	7.3	1.0
BLS adjusted[3]	55.2	61.5	54.5	(2)	(2)	6.3	(2)	(2)
United States	46.3	53.6	46.0	42.0	29.5	7.3	7.5	-0.2

1. Refers to annual average data in Canada, Sweden, the United States, and Japan (except for 1984, where an 11-month average was used. The data for Australia refer to the august survey and were chosen because it is the only month for which a historically consistent time series exists. The data used for West Germany are from the Microcensus and are collected each April/May. The microcensus data were chosen because they are the only labour force data collected in West Germany which conform to International Labour Organization concepts and definitions.

2. Unfortunately, separate estimates of employment of the sexes aged 75 and over were not available to calculate the relevant employment-population ratios.

3. The Published Swedish data are shown as "adjusted" and refer to the population aged 16 to 74. BLS calculations of the labour force participation rate and employment population ratios for the population aged 16 and over are shown as "BLS adjusted."

4. The latest data available are for 1983 and the data refer to that year.

Source: McMahon, P. "An International Comparison of Labour Force Participation 1977 - 1934". Monthly Labor Review, May 1986.